Small Business Innovation Research/Small Business Tech Transfer

Broadband Uncooled IR Detector Based On Nano-Electromechanical Systems (NEMS), Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Intellectual Merits:

This Small Business Innovation Research Phase I project seeks to develop an innovative Nano-electromechanical systems (NEMS) Lead (PB) Lathanum Zirconium Titanate (**PLZT**) based uncooled broadband infrared (IR) detector (NEMS PLZT) with average QE>50% over the spectral range of 3µm – 50 µm and detectivity D* greater than $5x10^9$Jones. This device will have a broadband spectral range to support MWIR, LWIR imaging at high performance. The design realized in Phase I through modeling, simulations and process development for fabrication of test-chips will be full developed and fabricated in Phase II during which the NEMS PLZT photon detector will be demonstrated as an uncooled broadband IR detector for NASA applications.

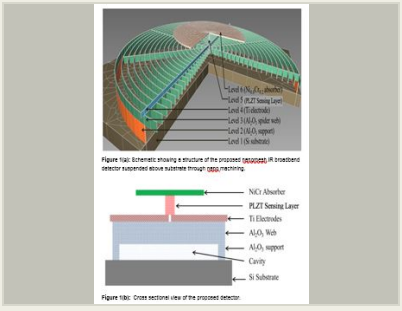
Broader Impacts:

This device will help to reduce the cost for high performance broadband IR imaging and enable wider adoption for space and scientific applications. Applications include IR camera for MWIR, and LWIR imaging, which are used in IR sensors for earth science measurements and observations for NASA missions such AIRS, TES, ASTER, HyspIRI**,** Sustainable Land Imaging – Technology (SLI-T) Landsat instruments, sensors, components, and measurement. Other application include military target detection systems for acquisition, tracking, and pointing of high power directed energy systems on next generation airborne platforms, intelligence, surveillance and reconnaissance platforms, LIDAR, remote sensing, satellite imaging, and the detection and monitoring of chemical and biological agents. In addition there are broad commercial sector applications including next generation automobile where this image sensor will enhance the safety of driver, passenger, and also pedestrian, security, biometrics, medical imaging, machine vision, and geo-science instruments.

Key Words: LWIR, MWIR, Focal Plane Array, FPA, night vision, thermal imaging

Anticipated Benefits

Earth Science missions, atmospheric science **AIRS (3.7-14.5 µm)**, measures air temperature and humidity for weather forecasts, and **TES (3.2-15.4 µm)**, measurements of tropospheric ozone from space. **ASTER (8-14 µm)**, for solid earth and hydrology science, and **HyspIRI** Mission, Visible-Shortwave Infrared (VSWIR) Imaging Spectrometer and a Multispectral Thermal Infrared (TIR) Scanner. **Sustainable Land Imaging – Technology (SLI-T) Landsat-9 Landsat-10** instruments, sensors, components, and



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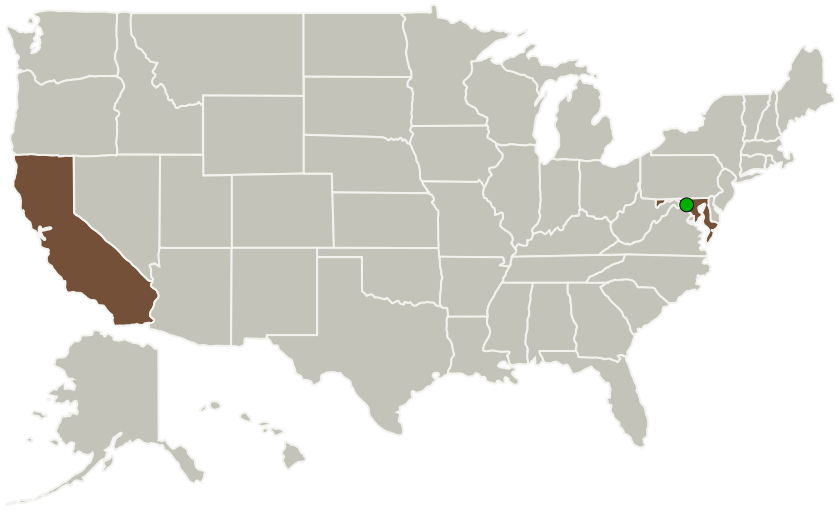
measurement.

Military and homeland security include target detection systems for acquisition, tracking, and pointing of high power directed energy systems on next generation airborne platforms, intelligence, surveillance and reconnaissance platforms, LIDAR, and remote sensing. Various commercial applications to benefit include Communications, Automobile, Medical Device and Scientific Imaging, Machine Vision, and Security & Surveillance market segments, which also includes the Aerospace & Defense.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Banpil Photonics, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Santa Clara, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Banpil Photonics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

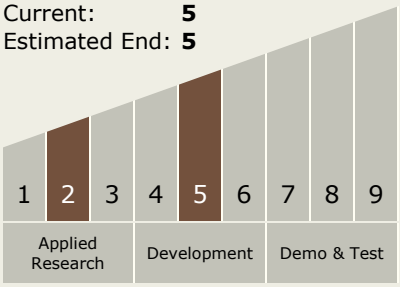
Carlos Torrez

Principal Investigator:

Achyut Dutta

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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Primary U.S. Work Locations	
California	Maryland

Project Transitions

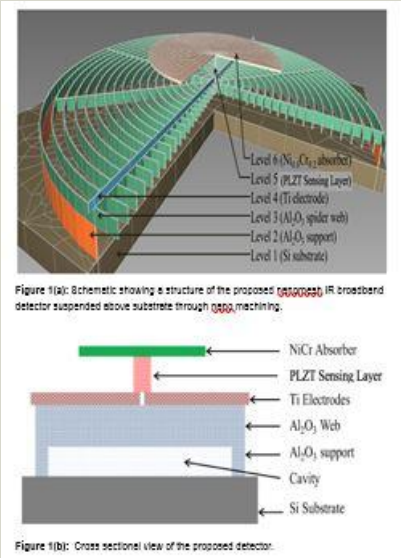
July 2018: Project Start

February 2019: Closed out

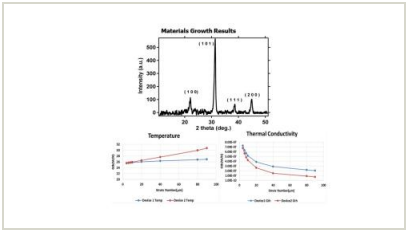
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140953)*

Images



Briefing Chart Image
Broadband Uncooled IR Detector Based On Nano-Electromechanical Systems (NEMS), Phase I
(https://techport.nasa.gov/image/128079)



Final Summary Chart Image
Broadband Uncooled IR Detector Based On Nano-Electromechanical Systems (NEMS), Phase I
(https://techport.nasa.gov/image/127882)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Earth